179. Heightening the Effect.

The different rooms in an architectural design may, as stated in Divisions 1 and 3, be divided into vestibules, communications, and principal apartments, according to their purposes. According to the importance of the rooms, a suitable gradation should appear in their decoration. In the order in which we pass through them to the principal apartment, there should be a transition from severe architecture of the exterior to elegant colored ornamentation. Therefore the vestibule and the entrance hall retain the character of the external architecture, and we economise decorative forms there, to heighten the effect in succeeding rooms by greater richness. Vestibules should be less strongly lighted than the principal apartment, to produce a gradual increase in lighting. The effect of rooms uniformly lighted by light from high above is materially increased if we enter through a darker vestibule. The highest effect in decoration and the most harmonious lighting is required in the chief apartments of the building. These should express in monumental designs the intellectual significance of the building, where the form of room, its decoration sculpture, and painting work together in a harmonious way.

DIVISION V.

VESTIBULES? STAIRWAYS, COURTS, AND HALLS.

By Professor Heinrich Wagner.

180. General.

Since the general designing of a building in plan, and section has been considered in the last Division, this last Division of Architectural Composition may then dismiss the arrangement of the building further, so far as it concerns rooms for common use, more or less developed in nearly every building, such as vestibules, stairways and courts. Designs for halls so commonly occur as entirely independent, or as portions of other buildings, that they are here subjected to general study.

The importance of stairways, vestibules, and courts, and their location and arrangement were discussed in Division 3 (Arts. 114, 126); their architectural treatment, with that of halls, was treated in the last Division. We now have to investigate their plans in general, their relations to each other, and to the principal parts of the building. From the intimate relation of these portions of the building, especially of the vestibules, stairways and courts, they cannot be separated, but are rather to be considered as a whole.

Chapter 1. Vestibules and Doorways, Entrance Halls and Corridors.

181. Diversity in Plan.

According to whether a building is to serve for public or private purposes, the plan of its ante rooms, vestibules, entrances, doorways, entrance

halls, and corridors, will have to be treated in different ways. These are the connecting rooms in the building, and their function is to facilitate passage from its exterior to its interior. This is true of both architectural treatment (Art. 179) and convenience of passage. They should harmoniously unite differences in form caused by external and internal influences, just as they lead from the hurry of the exterior to the life of the interior. This assumes that entrance rooms of a private house should be much smaller than those of a public building, whose interior is always intended for the use of the external world. And since every prominent peculiarity should be reflected in the architecture, this would assume a more purely internal character in entrance rooms of a private house, than in those of a public building. Especially in the corridors, which are the vestibules to each story, but less so in vestibule and entrance hall to the interior of the building; least of all in buildings for large halls, the corridors partly forming an extension of the building outward, partly a passage or corridor around it,

In such designs climate plays an important part, and the treatment must be arranged to suit it. Entrance rooms in northern countries must afford protection from rain, snow, and cold, and they must also be partially warmed, while in the warm countries free access of air and protection from scorching sun are required. Halls and vestibules may be treated with more beautiful and dignified effect, whose climate is mild and pleasant. Entrance rooms may then be more freely open, appearing better and more clearly on the exterior of the building. Their plans are to be considered in connection with the location of the entrance, on which the arrangement of all entrance rooms depends.

a. Plans of Halls.

182. Porticoes, Arcades, Colonnades, etc.

Entrances to buildings frequently form imposing rooms opening externally, like porticoes of ancient temples, which project from the structural organism itself, and are both simple and noble models of one story designs. In Figs. 245 to 247, the portico is brought under the same roof with the temple cell, sometimes at only one end, sometimes at both, also frequently extends along the sides. In Fig. 245 it has the character of an enclosure, but in Figs. 246 and 247 it is an open portico. It is an esthetic requirement that such porticoes should not be set directly on the earth, but should be raised and commence on a substructure; they would otherwise have the effect of growing out of the ground and would not appear like free artistic creations; their general design would lose much in independent effect.

Due importance was assigned to porticoes in the architecture of all periods; in scarcely a public building in antiquity, were they wanting. They were either covered by a horizontal ceiling or by vaults. Openings were either rect-

angular or arched, subdivided by piers or columns. These open porticoes (colonnades or arcades) are not merely in a single story, but also occur in several stories, according to whether, as in large Grecian temples, the external order occupies the entire height of the structure, only in the interior being two orders above each other, or whether the subdivision into stories extends to the exterior.

Excellent examples of the former are portico of Schinkel's Museum in Berlin (Figs. 91, 249), Klenze's Glyptothek in Munich (Fig. 248), Semper's Capitol in Winterthur (Fig. 206), and Hansen's Academy of Sciences in Athens (Fig. 252). Typical buildings of the latter kind, among other elegant creations of the Renaissance are Belvedere at Prague (Fig. 250) and Basilica at Vicenza (Fig. 251). The former was built by Paola della Stella after 1536 and is surrounded by porticoes; the latter has two stories of porticoes, Andrea Palladio having rebuilt the old Palazzo della Ragione as a "Basilica". The simple grandeur of the first strikes the eye; in the latter, the exterior consists of arcades, but has the genuine character of the portico, although dominated by the inner nucleus of the building in the most effective manner. Arcades or colonnades appear as projections or porticoes, and very frequently as loggias and recesses with closed ends. In all cases the porticoes serve to freely open externally the walls of the facade, sometimes in the lower story (Fig. 198), sometimes in the upper one (Fig. 206), also occasionally in several stories.

183. Street Porticoes and Verandas.

We find on many buildings, especially in southern countries, external porticos extending along the lower story, covered and forming open passages protected from sunshine, and syited for work and life in the open air, so dear to southern races. They also frequently occur in the German Renaissance. Streets occupied on both sides by high buildings, especially whose lower stories have porticoes or verandas, generally produce a heavy and unpleasant impression. Projecting structures of every kind, especially porticoes, are obnoxious to governments sometimes compelled to fight in the streets, or to march soldiers through them although such structures must have been common in many cities, where no longer found. For political reasons Rome and Naples have no street porticoes.

With these useful and often very picturesque designs, the principal entrance to the building is with difficulty recognized; the portico no longer invites entrance into the building; it even partially obstructs light to the rooms behind it. It is therefore customary to make them as light as possible, when such proticoes are built, (as for example at hotel "Frankfurter Hof" at Frankfort-A-M., Fig. 253, and the new arcades adjoining the City Hall at Vien-

na, Figs. 254, 255). From the faults mentioned, such porticos have fallen into disuse in northern Europe. At the beginning of this century and even a few centuries since, they were frequently employed, as in Rue de Rivoli and other streets in Paris (Fig. 254), likewise in Carlsruhe, etc. With few exceptions (as the examples in Figs. 253, 254), they have been almost entirely replaced by modern street porticos and shops with large show windows.

184. Connecting Porticos and Promenades.

If porticos are only intended to form covered promenades and resting places without enclosed rooms beside or above them, these creations belong to a class claiming especial importance. They usually also serve as an elegant and architecturally effective connection between several buildings or parts of buildings (Figs. 253, 257), or to extend them externally. The courts of Egyptian temples were thus surrounded by porticos, as well as most public squares of the ancient Greeks and Romans, these being connected with public buildings as well as with private houses. The porticos of Pompey and Octavia in Rome were favorite promenades of wealthy youths. Those of the Forums, Baths, Gymnasiums, etc., likewise played a great part in daily life.

An example in the Italian High Renaissance is the noble portico by Bernini (Fig. 256), which encloses the Place before St. Peter's Church in Rome. The front portion is an elliptical enclosure with four rows of columns about an uncovered area, at its centre being the obelisk with fountains at each side. The rear portion is enclosed by simple straight porticos diverging towards the church to make the smaller place appear larger and deeper. A similar design, consisting of porticos of quadrant plan, was erected before Kazan Cathedral in St. Petersburgh, and Alexander I had it built by Varonikin in memory of the victories of 1812-15.

The same motive forms the basis of several examples produced in recent years, such as the porticos of the magnificent Palace of Longchamp near Marseilles (by Esperandieu, 1862-70), and those of the Palace of Trocadero in Paris (by Davioud and Bourdais, 1878). The colonnades of the former (Fig. 257) merely serve as promenades connecting the angle buildings with the central building, while those of Trocadero Palace are also utilized for exhibitions, and are enclosed at the rear by a wall.

185. State Porticos and Loggias.

To these architectural designs are to be added state porticos, which do not serve as promenades, but are chiefly devoted to public uses. Here belong detached open loggias which especially occur in Italy, and which are to be considered as independent buildings. One of the finest examples of this kind is Loggia dei Lanzi in Florence (by Orcagna, 1375). The three great arches with an arch at each side, in the facade of the loggia are of imposing dimen-

sions (Table, Art. 100), but are so elegantly treated and so intimately connected with the cornice, that the building is unsurpassed in this respect. Other porticos enclose tombs and courts of monumental cemeteries, also cloister courts, etc. Further discussion will be left to Chapter 3 (Plans of Courts) and pater volumes.

186. Treatment of Porticos.

In the treatment of porticos, especially of vaulted arcades, it is essential to devote the necessary attention to the endings at their angles, and it is usually advisable for structural and esthetic reasons to strengthen the supports there. This is generally done by placing columns, pilasters, or piers before the members supporting the arches. If porticos are arranged in several stories, care is usually taken to treat the lower story in forms suggesting greater strength, passing upwards into lighter forms. We may begin with the Doric or Tuscan Order; the Ionic will follow, then the Corinthian, perhaps caryatids or Hermes-like piers. The latter will have a good effect only when at a moderate height, for when higher from the ground, their detail forms will not be visible, and the artistic value of the figures will not have its full effect. For formal treatment of porticos, we refer to Part I, Vol. 3 of this Handbuch.

187. Galleries, Corridors, etc.

The use of externally open porticos and loggias is naturally limited in our climate (Germany). They are so much exposed to wind and weather, that when intended for connecting apartments, they do not accord with our views and customs. Yet the portico is such an effective element of architectural composition, that it must be regarded as indispensable. A simple means of employing them without these injurious effects, consists in treating the openings as windows and glazing them, otherwise retaining construction and treatment of the portico in all essential parts. This is now common, especially in new buildings. Even the famous Loggias of Raphael in the Vatican in Rome were enclosed, and their imitations, the loggias of the Old Pinacothek in Munich. These cannot produce the strong effect of shadow found in the open porticos. Their place was taken by glazed galleries and corridors, which otherwise exhibit the same monumental character. This is illustrated by Fig. 258, from Palace of Justice in Paris (by Duc and daumet).

b. Entrances and Doorways.

188. The Entrance.

The entrances are parts interposed between exterior and interior of the building. Entrances to buildings have been artistically treated from ancient times) The more conspicuously the mass of the building is treated, which separates the public square or street from the interior of the building, the great-

er is the need of emphasizing the connecting entrance. It should always be so treated that access through it to the entire interior of the building is evident, and one is not required to seek another entrance. Independent gateways are detached from the building or loosely connected with it, usually when the structure stands in the middle of grounds, or is built back from the street or road then requiring an enclosure, entered through the gateway. (Fig. 259).

189. Location.

The location of the entrance is of very particular importance; this was mentioned in Division III (Art. 126) as one of the chief points in arranging the system of passages in the building. As for the appearance of the building the portal usually is an artistic accenting of the principal axis of the structure. The entrance to the building should be recognizable at the first glance, and the axes of the principle facade, or those of the different prominent masses of the structure, are the places where they are sought and should be found.

It is not always possible to place the entrance at the centre of the facade. This occurs when all rooms in the front of the building must form a connected series, or when the length of the front is so small that a division in two halves would be unsuitable for rooms to be arranged at each side. The entrance is then placed left or right of the centre, frequently at one end of the facade, or often being even in one side of the building. The latter is permissible in short facades, especially in freely grouped structures, if the doorway is readily seen from the front. But the rear of the building is never suitable for the main entrance, only for entrance for purveyors, servants and private persons. In buildings at the corner of the street, it is usually best to arrange the entrance at the corner, especially when much used. (Art. 212; Fig. 305). If the structure surrounds a court, it is advisable to so arrange the entrance that one may directly pass from it into the court. This entrance will then be like a portico and is usually intended to be a carriage entrance.

190. Separate Entrances.

A single doorway is seldom sufficient for large buildings; several entrances are frequently necessary to lead to different parts of the structure, since they serve for varied purposes. With sufficient length of facade, they may then be symmetrically arranged on one facade, so far as they have nearly equal dignity. But it is frequently hard to adopt the latter arrangement to the requirement of recognition of the main portal, and with due regard to internal subdivision of the building. When several entrances are necessary, they are usually placed in different sides, if these are accessible.

Distribution of doorways to the principal and side facades, or the greatest possible division and separation of the several entrances is indispensable,

if separation of persons entering the building is for good reasons advisable or necessary. This is the case with all designs, where great numbers of persons are to be admitted in brief time to the interior, or are to find exit therefrom.

First is a separation of entrances for carriages from those for persons on foot, which is possible in various ways, especially by arranging the portal on the main axis for persons, placing the carriage entrance at one side, or the converse. Instructive examples are shown by plans of theatres, halls, concert halls, etc. (Figs. 178, 275, 312). This separation is more difficult on a single facade, if other buildings closely adjoin both sides. Yet the entrance for persons may be placed beside the carriage entrance and combined with that into a single entrance portico (Figs. 261, 254); in simple buildings, a single doorway is usually provided for both purposes.

191. The Portal.

The portal distinguishes the entrance and as an attractive and rich enclosure of the doorway should appear as a prominent part of the building. The general form and decoration of the portal have been treated with especial liking by architects in all the best architectural periods. In no other portion of the building may be found such abundance of the most elegant creations. The architecture of the modern period has sought its models in the extremely varied and peculiar forms of Renaissance portals. Some examples are shown in Figs. 194, 202, 203, 204.

192. Forms.

In regard to dimensions and forms of entrance doorways, in order to make them easily recognizable, they must be distinguished, both by prominent size in proportion to other parts of the building and by richer ornamentation, but must also appear as belonging to the entire building and intimately connected with it. The architectural treatment of the doorway may partially express the purpose of the structure. If an entrance is heavy, wide, and low, it has the effect as if the building is intended to keep fast of hold of persons as well as of things, like prisons, arsenals, etc. But if the entrance be light and lofty in proportion to its width, apartments may be expected within for magnificence and festal enjoyment.

A very characteristic form of free opening toward the exterior is common in portals of mediaeval churches and cathedrals, consisting in an arched treatment of the opening enlarged externally. No less characteristic and equally inviting is the arrangement of an outer gateway, whose plan is usually a half ellipse or oval, and which makes a kind of niche-like vestibule as a portal. Strongly covered members and recesses of many doorways and gateways result from the same esthetic feeling. Such views harmonize with another mo-

tive, revived into fashion very recently, for accenting doorways and porticos of monumental buildings. It consists in the Roman triumphal arch. It was used by Semper and others with more or less success on theatres, exhibition palaces, parliament houses, and other state buildings, whose size and importance are to be made prominent.

193. Entrance Porticos.

The entrance frequently leads through a covered portico, sometimes open and sometimes closed, either placed entirely before the facade, as in Figs. 248 to 250, or as in Figs. 260, 261 arranged entirely within the building between adjacent apartments. In both cases it is generally necessary to set the building back from the building line of the square or street as much as the depth of the projecting portion. Entrance porches are sometimes found on Gothic churches, with a plan in form of a triangle or pentagon, one side containing the entrance doorway, the two others being treated as openings for passage (Fig. 262). Porticos may serve as entrances or gateways for carriages; they then recieve different names according to their arrangement and have the advantage that one may enter the building with clean shoes. Covered carriage porches are preferable to carriage passages, which are easily exposed to draughts of air.

194. Carriage Porches.

Placing the entrance beneath a covered carriage porch is preferable in palaces and large public buildings. Floors of such porches must not be elevated. Ramps are arranged at each side, and must not be too steep, being the longer, the higher the carriage porch is raised. Fig. 264 shows an uncovered drive, and the ground story plan in Fig. 178 shows two with projecting roofs; Fig. 263 is a carriage porch with curved ramps, Fig. 266 is one with straight ramps, and Fig. 265 is a carriage porch at an angle. Besides the ramps of the carriage porch, it is customary to arrange steps before it on the exterior, (Figs. 263, 266), and these afford a welcome motive for architectural treatment.

Carriage porches are to be harmonized with the exterior of the building, and are therefore to be built of the same material and with the same treatment of forms as the latter. If the carriage porch be only a protecting roof supported by light iron columns, it merely appears as an accessory of the building, or like a foreign element attached to it. The esthetic impression of such treatment is seldom entirely pleasing. The effect of the entrance itself is thereby injured.

195. Carriage Passages.

Carriage passages or drives, and gateways, termed gateway porticos if sufficiently spacious, are enclosed by simple subdivided walls, or developed like a portico with colonnades or arches. If they are also used by persons on foot,

these are protected by a corresponding separation, either by a raised walk or by a colonnade (Fig. 287).

The carriage entrance is also generally an exit, so that carriages must turn around in the court of the building. If a large number of carriages is to be expected in both directions and at the same time or if it is impossible for carriages to turn in the interior, separate carriage entrances and exits are advisable. These may be on different sides or on the same side of the building, and will preferably be so arranged, if the building site directly adjoins the street at the sides or rear (Plan in Fig. 185), or when the plan permits both to be connected together by a double entrance portico, or a carriage passage is provided at separate and suitable points of the main facade of the building (Fig. 288, 307).

c. Vestibules and Entrance Halls.

196. The Vestibule.

The passage from entrance portico to interior of the building is formed by the vestibule or entrance hall. By vestibule is not to be understood only the ante-room next the entrance, separated by this from external connection with the street, court, or garden, but it also signifies the hall, which forms a passage to the different rooms on the same level and also frequently contains the entrance to the staircase leading to the upper stories (Fig. 289).

In Italian palaces of the late Renaissance, the vestibule was much increased in size to accomodate numerous servants in attendance on visitors. The gateway was then treated as a carriage entrane and was made large and wide. Vestibules in Florence by Bramante were seldom more than a passage with tunnel vault, but became a larger and higher vaulted room. The vestibule became one of the highest problems, for the staircase (next Chap.) had before been merely dignified and convenient, was then presented to the eye and to the imagination as an element of beauty, and was directly included in the vestibule. The entrance hall became of equal importance with similar halls in northern and southern Germany. In the upper stories, this forms an ante-room like the hall on the ground floor, a corridor or passage to the rooms.

197. The Entrance Hall.

This ante room for passage will then be termed the entrance hall or vestibule, when especially spacious or remarkable, being usually designed somewhat like a portico, and frequently decorated by sculptured and painted ornamentation. As the first rooms entered by a visitor, the vestibule and entrance hall decide the impression made by the interior. If the building contains fesal apartments, the entrance hall must not be prominent for especial magnificence in decoration; it must not excel the apartments in this way, and must not delay the visitor on its own account, but rather by quiet and noble forms

of stone architecture and by similarity to the external architecture prepare him for the increased effect presented by the internal decoration of the apartments.

198. Treatment.

The entrance hall is that room through which passage is opened to the principal portions of the interior (Fig. 270), but it is not usually a room for attendants, only for passage, with a separate room for the porter added to the side. Being not intended for a continuous occupancy, the vestibule or entrance hall should be less lighted than the other rooms, where good lighting is a chief requisite; in palaces, it usually receives indirect light only, since its central location and the carriage porch and other arrangements before the main entrance prevents direct lighting. The vestibule should be so arranged, that if not square, its larger axis may have the direction of the depth of the building, its smaller axis being that of the facade or parallel to the front (Figs. 271, 273). It is frequently necessary to keep the part next the entrance on the same level as the portico or threshold of the entrance, then ascending by steps to those parts of the entrance hall at a higher level. (Figs. 271, 272).

By the rooms placed over the reception hall and the requirements for supporting them, one must be guided in the treatment of the entrance hall; it therefore frequently has columns, piers, etc., to support the ceiling, and these are to be arranged regularly on both sides of the principal axis. With two rows of columns, a central wider passage and two narrower side passages may be arranged (Figs. 272, 281). But the entrance hall appears more dignified if without dividing columns. The use of columns partially depends on the height which may be given to the entrance hall. If they are not to appear stumpy, for relatively small height free columns are advisable, to produce a good effect by dividing the available space into several narrower spaces.

In palatial buildings in southern Europe as frequently in Italy, the entrance hall occupies at least one and one-half stories, a mezzanine story being usually placed above the ground story, above which is the floor of the principal story; vaulting the rooms is customary in southern Europe and requires so much height that the entrance hall cannot be made low. It is always desirable for the entrance hall to have a respectable height, and therefore it frequently extends through two full stories. An entrance corridor is sometimes arranged in an upper story also, especially in the principal story, as in Fig. 274.

199. Peculiarities.

In many buildings entrance halls receive a peculiar treatment, required partly by local conditions (Fig. 105) partly by the special purposes they are to fulfil. Without going into details of plans, a few typical examples are illustrated. An important part is played by entrance halls in theatres and oth-

er buildings, intended to receive great numbers of persons. It is advisable, especially in northern Europe, to place wind screens at entrance doors leading to entrance halls. In entrance halls of theatres several entrance doors are arranged (opening outwards). If external walls are sufficiently thick to have sufficient space between doors placed at outside and inside of wall, the use of wind screens will be avoided; it is advisable to avoid an internal projection of wind screens by adding a separate thin wall in the entrance hall to form a vestibule, only beyond this wall treating the entrance hall as a united room. (Compare Figs. 275 and 178).

For churches it is appropriate to pass from exterior to interior through an enclosed vestibule, to protect the interior of the church from draugths, also providing an ante-room, where persons may form in processions before entering the church. A prominent part in modern architecture is played by waiting rooms of great railway stations. From their peculiar requirements and account of the enormous traffic, they sometimes have colossal dimensions and a peculiar develo ment.

In English country houses, the entrance hall is generally an entirely closed apartment or noble hall that can be warmed, and in accordance with ancient traditions, it forms an indispensable part of the family residence, being accordingly decorated by paintings, arms, hunting trophies, etc., though frequently treated in a more simple and common manner (Fig. 276). A quite different character appears in the vestibule of French private residences. Just as nobly treated in its way as the English entrance hall, it does not produce the same impression of cosiness and comfort, but by its formal treatment always is a pleasing transition from the external architecture to the internal decoration (Fig. 277).

200. Waiting Corridors.

With vestibules and entrance halls belong waiting corridors, which are in France common in Court Houses, etc., the so-called Salles de pas perdus. These are long corridors to which the public is restricted, sometimes transacting necessary business with officials, sometimes awaiting an order to enter the court room. These rooms are high, airy, and are treated with massive richness, always with a severe character. (Figs. 278, 279). Many halls in other kinds of buildings possess a similar character (see Figs. 280, 317a).

Chapter 2. Plans of Stairways.

201. General.

"Very careful attention is required to designing stairways; for difficulties are great, to be overcome in giving them a suitable location, and one not injurious to the rest of the building. Praiseworthy are staircases that are light, spacious, and easy, thereby inviting one to visit the building".

In nearly these words in Chapter 28, Book 1 of his "Architecture, Palladio points out the chief requirements for these important connecting members of the structural organism. Very much depends on correct arrangement of the staircases. Yet this will be materially simplified by that said in the last Division in reference to planning the building in general, and that in Part III of this Handbuch on their arrangement and construction, parts in detail, and on external staircases. There remains the designing of staircases in the interior of the building, especially those of monumental character.

a. Forms of Staircases.

202. Historical.

To characterize staircases of different periods of art, the following points become prominent. In antiquity, staircases in the interior of the building could acquire no importance. Principal apartments were limited to the ground floor; stairways leading to upper stories were enclosed between walls, and appear to have received no architectural treatment, and were quite steep. This is assumed from the writings of Vitruvies (Book IX, Chap. II) and is proved by extensive and partially preserved staircases of Roman amphitheaters, planned with extraordinary skill, to provide access to all parts of the building for great multitudes of persons, with quick egress for them in the most perfect manner. Staircases of mediaeval buildings are generally placed on facades in open stairways or stair towers and mostly consist of winding steps. Desire for richer treatment appears everywhere under influences of late Gothic and Early Renaissance in numerous gracefully grouped and effective creations. The monumental stairways in interiors of buildings are among the creations of the Italian Renaissance, and they have been transferred to modern architecture without material change. Especially in public and palatial buildings, while dwellings have comfortable, and attractive staircases.

Stairs will be considered from the point of view of suitability, without reference to diversities in material, construction, and form.

1. Stairs in Straight Flights.

The steps of the staircase sometimes continue in one flight without interruption, but they are generally at proper intervals divided into separate flights by walking spaces or landings, with or without change in direction. The most varied forms result from influences affecting arrangement in the interior of the building, yet these may be classed under a number of simple types.

203. Straight Staircases.

The form most convenient and appropriate for ascent and descent is the straight staircase without turns from beginning to end. It may be enclosed between two walls extending beside the steps (Fig. 281) be built free on both sides in the

room (Fig. 282), or may be free on one side and built against a wall on the other (Fig. 283). In all cases, particularly if the height is very great, this requires a great length of space, and in the first case a considerable width as well, if the staircase must not appear very narrow in proportion to its length and height. If several staircases of this kind must be placed above each other, the maximum distance must be traveled in passing from floor to floor. But if not required to economize space, the straight staircase is grand and simple in general effect and is not excelled by any other. It is therefore particularly adopted to monumental buildings, either is single or double in plan, or may be arranged symmetrically to A B or C D (Figs. 281, 283).

One of the noblest structures of the first kind is the Scala Regia (Royal Stairs) (by Bernini) leading to pontificial apartments in Vatican at Rome (Fig. 284), which extends in a single flight for more than 197 ft. in length, and even appears much longer in perspective than is actually the case, for between the pair of columns its width at the lower end is 27.5 ft. this diminishes to 16.4 ft. at the upper end. A magnificent example of straight double staircase was in Hotel de Ville in Paris, destroyed in 1871. Fig. 311 represents on one half, the plan of the ground story, on the other being that of the principal story.

Especially in stories at upper ends of such staircases, they are furnished with galleries to connect them with the adjoining rooms, and these are either treated like porticos (Fig. 311), or are free above and are merely enclosed by balustrades next the staircase (Fig. 281). As a simple staircase before halls in entrance halls, in courts, etc., the straight staircase, as in Fig. 282, is very frequently employed. (Fig. 280, etc.). This type is also used for ordinary stairs with moderate height of story, if arranged along a passage required for communication or in a generally accessible space.

204. Staircases in Several Flights.

The direction may generally be changed for each flight between landings, producing staircases in several flights. If this change always occurs in the same direction, a simple staircase results, if in both directions, we have the double staircase in two flights.

205. Staircases in Two Flights.

The staircase in two flights is formed when the upper flight forms on the plan an extension of, or a right, acute, or obtuse angle with the lower flight, the latter are rare. The staircase in Fig. 285 is divided in two flights at right angles, and its entire length appears at a glance, the lower flight appearing in front view and the upper in side view. Suitable treatment produces an interesting or even picturesque and effective view. These advantages make the staircase very appropriate, where as in Fig. 276, it is built free in the

room and forms a part of its decoration. That it is suited to even monumental buildings is shown by Fig. 285, also by plans of the Palace of Archduke Ludwig Victor in Vienna (Fig. 185), and by upper and lower entrance halls of Capitol at Winterthur, furnished with two such staircases (Fig. 310d).

By far most comonly used is the half space staircase, as in Fig. 286; for it is easily and compactly arranged with rooms of ordinary depth, is enclosed by itself, permits access from principal landing to the different rooms in that story, and at the same time ascent to the next story takes the shortest way. This is the most appropriate form, though not the most elegant in its appearance, since the upper flight of the stairs usually appears from beneath a dark mass; and as it cuts across the opening at midheight of the story, it partially obstructs the view in the stairway. This frequently occurs in Italian palaces (Fig. 272). Flights of stairs are there quite broad and are mostly enclosed between side walls, each flight appearing by itself as in straight staircases. As a principal staircase extending from one story to the next, it ends above in open form; external defects then dissapear, and it is partly not visible on account of the enclosing walls and the ending of the up er part of the stairway, as shown by Fig. 286 (plan of ground story). It is often preferable to round off angles of the landing according to dotted lines in Figs. 286, 292.

206. Staircases in Three Flights.

Combining ty e forms in Figs. 285, 286 produces a staircase in three flights, as in Figs. 273, 287, a third short flight being added below or above to the half space stairs, usually at right angles to the middle string or wall, so as to begin or complete the ascent. This gives the lowest or second upper story greater height, without being com pelled to require larger space for the stairway, with equal rises of steps. This form is likewise very frequent in Italian palaces. A good effect is also produced by three space staircase, which changes direction at right angles in Fig. 271, 288, especially if the second flight can have a greater length than the other two, producing a less obstructed view in the stairway (Fig. 277).

207. Staircases in Four Flights.

Likewise originated full space staircases, where as in Fig. 289, the flights from landing to landing turn at right angles, and end above the point of beginning. Staircases in Figs. 288, 289, are open towards the well-hole, and when several stories are arranged above each other, they recieve light through skylight. They therefore possess special advantages for location in the interior of the building, and as shown by numerous examples and by the given plans, they are capable of effective architectural treatment. Both forms demand rather more floor space than many others on account of well-hole enclosed by front

room and forms a part of its decoration. That it is suited to even monumental buildings is shown by Fig. 285, also by plans of the Palace of Archduke Ludwig Victor in Vienna (Fig. 185), and by upper and lower entrance halls of Capitol at Winterthur, furnished with two such staircases (Fig. 310d).

By far most comonly used is the half space staircase, as in Fig. 286; for it is easily and compactly arranged with rooms of ordinary depth, is enclosed by itself, permits access from principal landing to the different rooms in that story, and at the same time ascent to the next story takes the shortest way. This is the most appropriate form, though not the most elegant in its appearance, since the upper flight of the stairs usually appears from beneath a dark mass; and as it cuts across the opening zt midheight of the story, it partially obstructs the view in the stairway. This frequently occurs in Italian palaces (Fig. 272). Flights of stairs are there quite broad and are mostly enclosed between side walls, each flight appearing by itself as in straight staircases. As a principal staircase extending from one story to the next, it ends above in open form; external defects then dissapear, and it is partly not visible on account of the enclosing walls and the ending of the up. er part of the stairway, as shown by Fig. 286 (plan of ground story). It is often preferable to round off angles of the landing according to dotted lines in Figs. 286, 292.

206. Staircases in Three Flights.

Combining ty pe forms in Figs. 285, 286 produces a staircase in three flights, as in Figs. 273, 287, a third short flight being added below or above to the half space stairs, usually at right angles to the middle string or wall, so as to begin or complete the ascent. This gives the lowest or second upper story greater height, without being com pelled to require larger space for the stairway, with equal rises of steps. This form is likewise very frequent in Italian palaces. A good effect is also produced by three space staircase, which changes direction at right angles in Fig. 271, 288, especially if the second flight can have a greater length than the other two, producing a less obstructed view in the stairway (Fig.277).

207. Staircases in Four Flights.

Likewise originated full space staircases, where as in Fig. 289, the flights from landing to landing turn at right angles, and end above the point of beginning. Staircases in Figs. 288, 289, are open towards the well-hole, and when several stories are arranged above each other, they recieve light through skylight. They therefore possess special advantages for location in the interior of the building, and as shown by numerous examples and by the given plans, they are capable of effective architectural treatment. Both forms demand rather more floor space than many others on account of well-hole enclosed by front

string, but they are otherwise easily arranged in plan, since they afford a suitable oppurtunity for varying ratio of length to breadth of stairway. But there is a minimum limit, fixed in accordance with Art.220, which is that not less than three or four steps must be placed between landings.

208. Staircases in Two Branches or Doubled.

The most diverse forms of staircases are produced from the simple type forms by doubling them on the axes of entrance hall or vestibule, and which are given by lines A B and C D in Figs. 281, 283 and 285. These compound forms require no extended explanation, being readily derived from the preceding, and their use in interiors of buildings will be treated hereafter. The most useful staircase in two branches is that formed from Figs. 285, 286 and 288 by symmetrical arrangement about the axis A B of the middle flight, with which it begins, and which is divided to right and left. Repeated on the axis C D, it may be termed a double staircase. Examples are the staircase in Fig. 290, that in Fig. 240, and that in corner building in Fig. 305; also in Fig. 307, etc. In Fig. 305 the entrance to ground story is found on bisecting line of the angle, and therefore in this direction is the entrance to the staircase, but the exits in upper story are on both sides perpendicular to corridors parallel to street facades.

It may be said with regard to these staircases in two branches, that their effect is more spacious and stately than that of simple forms, but the demand for space is correspondingly greater. And when space is not abundant, a simple and spacious staircase is decidedly to be preferred to one of two branches, restricted in plan (see Art. 221). Burckhardt says that a chief innovation in the architecture of palaces in Late Renaissance consists in doubling staircases for sake of symmetry, after men had already become accustomed to such in gardens and courts after Bramante. They either commenced below with two separate staircases, or one staircase was divided in two above the first landing. Great merit is due to Genoa with its steep flights of steps, where care must always have been taken to obtain for the numerous external stairways a good and beautiful effect.

2. Winding Staircases.

209. Simple Forms.

Instead of changing the direction from landing to landing, as in the preceding straight typical forms, this may also be effected from step to step by winding staircases with a solid newel or a well-hole. These are either entirely of winders, as in Figs. 293, 294, or partially so, but usually are enclosed by a semicircle. Winding staircases are easily adapted to either a semicircedcular or polygonal, an oval or rectangular room, and is therefore more read-

ily employed on an irregular building site, than are stairs of other types (side stairs in palace, Figs. 185, 188). They occupy least space on plan, and admit of access at any height and at all points of the perimeter; they are also the only form suited to any stride, since on the radial steps may be selected at pleasure any proportion of tread to fixed rise, both ascending or descending.

This type has the defect in case of small radius, that the change in direction from step to step is perceptible, ascent and descent being quite troublesome, but this almost entirely dissapears with a larger well-hole. On account of this difficulty the winding staircase is not employed where it is preferable for its other advantages, as when the arrangement of straight staircases is objectionable for local reasons (lack of space, irregularity, etc.). It was previously stated that winding staircases almost exclusively employed during the middle ages and the Early Renaissance.

As historical examples in Italian buildings, which seldom exhibit this typical form in the interior, are the circular staircase in Belvedere of Vatican (by Bramante, 1508), and the later oval staircase in Barberibi Palace in Rome (by Borromini), only differing from the former by its elliptical plan (Fig. 294). Both are of considerable dimensions (about 29.5 ft. in clear width); the hollow newell is composed of twelve Doric columns, which follow the helical curvature of the strings and balustrade. Among designs of allied type, though of different form, are the elegant winding staircases in middle and southern Germany, mostly of the 16th century (Fig. 298); then among numerous French examples of Early Renaissance is the beautiful newell staircase of Chateau of Chateaudun, of beginning of 18th century, Figs. 295, 297. Differing from most contemporary designs, the latter is enclosed in the building, permitting free passage between A and B.. The square plan is by conical vaults transformed into an octagon, and this into a a circle by the eight corbelled out columns supporting the helical cornice.

Modern architecture has rightly a changed to more simple forms of the staircases, at the same time with a practical limitation of their use. They are employed for minute uses in their most compact form as narrow isolated stairs with newells, but otherwise are only used for subordinate purposes, since they are entirely unsuitable for use by many persons. With a wide well-hole, they now occur as main staircases, usually in semicircular form, as in Fig. 291.

210. Compound Forms.

Winding stairs are suited to combine with straight ones. Most common is the type in Fig. 292, which may be placed in rooms ending in either rectangular, circular, or polygonal form, and which retains both the advantages and the de-

fects of the two forms composing it. It is appropriate where little space is available and an intermediate landing is omitted on account of low height of story, as in apartment houses and other buildings for purposes of utility. To insert a walking space in form of a sector of a circle instead of a few steps is more diturbing than advantageous, if the space is not wide enough to require at least two ordinary steps thereon (Art. 222). As main staircases, compound forms are usually arranged in two branches in monumental buildings. It is usual to commence with a middle straight flight, which branches from the landing in two curved arms (Fig. 298). Fig. 318 is a notable example. External straight flights of steps, much as usually entrance and exit steps, are usually constructed with more or less curved steps, gradually becoming wider (Fig. 177).

b. Arrangement and Form of Staircases.

211. Main and Private Staircases.

According to purposes and importance, main and private staircases are distinguished. The first is for public use in most buildings, but the latter is for private use and for the passage of the occupants. As a room for general use, the main stairway must be easily recognized and accessible; only in family and private residences is required a certain separation and isolation. But on entering public buildings, one should not doubt where to seek the main stairway. This does not alone usually suffice, since it generally ends free in the principal story, and it is desirable to so arrange that two flights may not come above each other.

To provide communication with the upper stories, side stairways are placed in larger buildings in addition to the main stairway, and these extend from cellar to attic. As service stairs, they provide servants with access to the housekeeping rooms, so that the main stairway is kept free; as stairs for private use, they are required to directly connect a series of rooms in different stories, but belonging together. Side stairs must sometimes serve for several of these purposes and be planned accordingly. But it is especially the main staircase whose suitable location and arrangement will cause difficulties.

1. Location and Direction.

212. Location of Principal Landing.

In harmony with the internal subdivision of the building, the main staircase is either located at an external side of the building, or more commonly at its center. It may then be partially or entirely surrounded by rooms. This is determined by the location of the principal landing, since accessibility of adjoining rooms is thereby fixed. If the principal landing lies in the interior of the building, then according to arrangement of entrance hall, the space in the ground story is divided in two equal parts, Fig. 299, or in two unequal ones, Fig. 300; both methods permit access to and from the staircase in the three

directions indicated. In most public buildings and in larger business buildings and stores, this separation is not objectionable, but it will frequently be very disturbing in private or apartment houses. Placing the entrance from facade to the side or rear beneath the intermediate landing is only permissible in ordinary or merely useful buildings, or in stairways of subordinate importance, according to Art. 169.

In smaller designs, the staircase and principal landing are placed against an external wall, obtaining the advantage that the rooms form a compact series (Fig. 301). Access to them can occur but in two directions. This arrangement is preferred in French plans, even for main stairways of larger buildings, as it becomes possible to place the windows above principal landing at the same height as other windows of the building. The same advantage is afforded by a location, Fig. 302, together with unbroken connection with all rooms, Fig. 301. This has the defect that passage must be arranged around the stairway, not only requiring much space but also a wider passage for reaching rear apartments. It is therefore seldom arranged in this way (Fig. 291). but is preferable if (Fig. 303) it opens into a court surrounded by porticos, or (Fig. 304) it gives access to several intersecting wings of the building.

The former arrangement is found in Austrian Museum of Art and Industry of Vienna (Fig. 337); the latter occurs in hospitals, etc. According to Art. 128, intersections of compound ground plans are generally suitable for location of stairways, lighted by sky lights, and also when wings of the building partially intersect, as indicated by dotted extension in Fig. 304. The principal landing may give access in the three directions toward the front and also directly sidewise to the passage to the rear. Thus in the School Building, Art. 131, and generally in all stairways placed entirely in the interior of the building. The last building shows that even for this location of the staircase, lighting by direct side light is possible. If the wings of the building form an angle, the staircase is sometimes placed on the line intersecting the angle. Here will be chosen either the arrangement in Fig. 306 or the staircase with two branches in Fig. 305. Among other advantages, the last has that of avoiding acute angles toward the stairway in Fig. 306, and one may enter from it either corridor of right or left wing. By arranging it as in Fig. 305 better lighting of the side corridor can be obtained, and a skylight must be provided.

213.. Accessibility and Separation.

Various plans in Figs. 299 to 306 show the location to be assigned generally to the staircase with regard to greatest possible ease of access to the main part of the building. Therefore, in large blocks of houses, barracks, etc. staircases are repeated at fixed intervals, are externally accessible, and are

mostly of fire-proof construction. But with accessibility, separation is also nec-essary in certain cases. Especially in private residences and also in buildings ope to the public, like theatres, halls, post-offices, etc., it is important to arrange the connection with the entrance halls, so that those ascending and descending may be protected from draughts. This is more difficult and more necessary, since stair-ways extending through the entire height of the building are esstential for upward ventilation. Wind screens are placed at proper points to prevent draughts.

214. Direction.

Besides the location of staircase is to be determined the direction of the flight of stairs in different cases. Both on entering the building and on reaching the up-per stories, one should not doubt how to turn to reach the rooms. This is best at-tained by ascending staircase directly from entrance without change of direction, and one can directly see the route from the main landing.

215. Beginning and Ending of Staircases.

It is usual to place the beginning of the staircase on one axis of the widely op-ened entrance hall, and that it may be more clearly seen, a number of steps someti are allowed to project into the hall. It is also desirable to have the last fligh of steps upward accord with axis of principal apartment of that story. Therefore if a large hall lies in the front of upper story, it is natural to make the arrang ment in Fig. 307; if it occupies a part of the rear facade, that in Fig. 308 is a a able one. In the last case, the room is reached without change of direction; in the first, a half turn is required at intermediate landing. In both, the beginnir of the staircase is on the axis of the entrance of the building, the end being on that of the hall.

If one of the halls or principal apartments is required in the ground story, thi hall is preferably placed on the axis of entrance hall and entrance, the beginnin of the staircase being placed on the transverse axis with a quarter turn to right or left (Fig. 310), so that wide passages beside the stairs (Fig. 308) may then for an attractive approach to the principal apartment, or staircases may be placed at each side of entrance hall(Fig. 272). The stiarcase is placed unconditionally in t direction of transverse axis, if (Fig. 309) it must be accessible from both front a rear sides, or a carriage passage, with which it is connected, leads through the building. In these and other cases, the plan is frequently symmetrically doubled about the principal axis, the entrance hall being in the ground story connected with two main staircases, which end in the upper story in a common hall (Figs. 310 310d) or at opposite ends (Fig. 311) to make different parts of the building ac-cessible.

216. Twin Staircases.

The same purpose is served by combining two staircases having a common intermed-iate landing, as arranged in a number of old and new buildings, and which may be

termed twin staircases. Thus Fig. 310e is one of the two main staircases of Technical High School at Charlottenberg executed with very imposing dimensions, and arranged parallel to main axis along the passages around the great inner court in center of the building and in two stairways, one above the other, to connect with the three stories. A person may start at A or B and ascend the staircase with a half turn in the direction of the arrow A-A or B-B, or travel in the approximately straight direction A-B or B-A. Also the main staircase of Opera House in Frankfurt -o-t-M (Fig. 314).

Two staircases may be combined in still other ways, when their junction is effected at the upper landing instead of on the intermediate one. This may be done when the principal story is two stories above the ground story. Since the staircase may terminate only in the main story, and in accordance with Art. 204, flights are not properly repeated above each other, the design must have such a length, that one must either ascend by a single staircase the entire height from ground story to principal story, which forms the second upper story, or reach the same point by two staircases placed behind or beside each other. The first leads from ground story to first upper story, and at its ending commences the second, which ends free in the principal story. The two stairways are thus placed in direct connection; one extending through the entire height of two lower stories, the other through that of two upper stories.

Such an arrangement is carried out in Technical High School at Munich, and is represented in Figs. 310a, 310b. The entrance to ground story is found on the main axis beneath the story landing. One may thence pass into the first upper story, or by the staircase divided in three branches, to the point lying immediately above it in the second upper story, where is the entrance to the large hall, or may change direction to right or left. The connection with the rooms in the rear is arranged in upper stories by halls at both sides and in ground story by one beneath the stairs.

217. Groups of Stiarcases.

Extraordinary numbers of people are to be assumed in many buildings, to ensure accessibility to all their parts in different stories. Particularly in theatres, concert halls, circuses, etc., it is necessary to regulate access of the public to different parts, especially to provide for quickly emptying the building, and this is done by separate fire-proof staircases, which occur in like number and arrangement of the main axis and lead to attractive entrances. (Plans of Lepzig Hall, Figs. 178, 181).

An example, where with reference to esthetic effect, both suitability and security were both taken into account in its design, is afforded by City Theatre at Riga, by Bohnsedt, Fig. 312. One may pass from entrance hall at p, and also from side entrance at p, to ground story vestibule and to landings at the same

height by means of the other ascents I, II, and III, which lead from the corresponding vestibules to staircases of the I, II, III tiers. These stairsa are both ingeniously and economically arranged as twin staircases (Art. 218) in three flights beside and over each other, but are separated from each other by massive partition walls and by landings. From the ground story upwards, the occupant of the I-tier uses the flight c, which terminates at x; that of the II tier first uses flight b, then a second flight carried over c, which likewise ends at x; finally, that of the III tier first ascends flight a, then a second over b and a third flight over c, to land at x. The crowding of the public is impossiboe if doors at y in the I and II tiers and those at z at height of the I tier are kept closed. Yet there must be opened between the acts, since no other staircases exist for passing fr,om tier to tier and to the foyer over the entrance hall at height of the I tier.

In large theatres (Paris, Vienna, Frankfort-o-M, etc.) a central state railway is placed between the side staircases of the different tiers. In Fig. 313 (Grand Opera in Paris, by Garnier), the side staircases open freely into the halls around the principal staircase and serve for all tiers. The ground staircase is reached directly from main entrance on the direction of the axis and through the great entrance hall from carriages placed beneath the audience room, by two flights of stairs leading upwards. Both steps and balustrades are curved as shown to produce a pleasing appearance of the entire stairway design. In Fig. 314 (Opera House in Frankfort-o-M by Lucae) side staircases are placed in closed stairways. In both, ascent of the main staircase begins in direction of the main axis while access to the tiers and to the foyer is diverted to each side of the building, so that the staircases must turn at right angles to the axis.

The same requirements, direction of flights of stairs at commencement and ending, frequently leading to opposite points of the axis, occur in many other examples (Figs. 317, 317a). On the other hand, the conditions and space at disposal frequently demand that the ending shall be directly over the beginning (Fig. 315). It remains to refer briefly to certain peculiar forms, composed of winding and straight flights of stairs (Fig. 316). The two-branched portions of these two staircases are in semicircular form with winding steps. The plan shows them at height of the upper landing. This floor of the upper story is partially occupied by an opening to light the lower rooms by ceiling light. Therefore, the type of plan and combinations of the two staircases, one behind the other, is as here represented.

2. Arrangement and Treatment of Forms.

218. Space Required.

Based on investigations made in this Handbuch, staircases are to be arranged

and executed according to the preceding principles.

The space required is first to be fixed, and depends upon :-

1. Ground plan of staircase, whether single or double.
2. Height of the riser and width of staircase.

219. Inclination and Stride.

Commence with the rate of inclination, since for a given height to be ascended the length of the staircase on the plan is thereby fixed. The tread and the riser are both in accordance with the dignity of the staircase and also with its height; they are to be made more convenient for the longer flights, or the greater the number of steps to be ascended in a straight line. Thus the Scala Regia (Fig.284) has 90 steps in a single flight, 41 steps being between first and second landings, and these steps have 4.75 inches rise to 20.5 inches tread. The staircase in the Ducal Palace in Genoa ascends 35.1 ft. from ground story to principal story by 80 steps, averaging 5.25 inches rise to from 18.2 to 17.7 inches tread, and these are interrupted by two walking spaces, while our more recent and less dignified monumental buildings seldom have more than 20 to 25 steps in a single flight, and less than 5.5 to 5.9 rise to 13.8 to 13.0 inches tread scarcely occurs; with a moderate height of story, two flights of steps usually suffice with 12 to 15 steps each, having 6.7 to 6.9 inches rise for 11.0 to 10.65 inches tread. For servant's stairs, 7.1 to 7.9 inches rise for 9.45 tp 7.9 inches tread are permissible, when height of story is not great.

It is to be remembered that ratio of tread to riser must be the same throughout. To effect this and to simplify the figures, it is recommended that heights of stories be made multiples of height of riser, just as the length of a flight of steps on plan is a multiple of the tread, thus requiring heights of the stories to vary slightly. (Not usually practicable). If the number of steps has been fixed, then is to be determinedin accordance with the chosen type, the division into one, two or more flights with landings between them. In fixing dimensions, the following points are to be kept in view.

220. Length of Flight of Steps.

As for distances between landings or length of a flight, the extreme limit is given by the examples and results just given. The usual rule that from 12 to 15 steps should be allowed in a direct succession in a flight is entirely correct, for it is based on the usual height of story and of riser, also requiring that at least one intermediate landing be arranged in main staircase in each story. The minimu length of flight is to be not less than three steps. Single steps should not be omitted to break a straight flight, since they are easioy overlooked, are disturbing, and may even become dangerous.

If several flights of steps extend above each other to the different stories

with appropriate arrangement of the plan and equal heights of stories, they must have corresponding head room; if heights of the stories differ bur little, then in lower stories one or two steps may be omitted from the flights and the width of landing increased accordingly. If the heights of stories are very different, typical forms of space stairs afford means of equalizing them, since in Fig. 309 the middle flight may be entirely omitted and to the landing be given the entire width of the stairway. If the ground story is higher than next story, this may be remedied by prefixing a flight at a proper place. But except for special reasons, equal lengths should be given to flights of steps placed over each other, to ensure that beneath the turns in the stairs there should remain sufficient head-room, not less than two-thirds to three-fourths the height of the story.

221. Width of Flight of Stairs.

The width of the stairs or length of steps is to be greater if enclosed between side walls (box stairs), than if open on one or both sides, and it must also be greater, the further the flight extends in a straight line. This is shown in Figs. 284, 311; it results generally that in monumental buildings a width of stairs from 8.2 to 9.84 ft. is not unusual, and in branched staircases the middle flight is generally still wider. There is also a minimum for stairs in two branches; for a certain width is necessary, even in a private residence, if it be used and is not to appear mean. This may be taken at about 6.56 ft. for the middle flight and at 4.92 to 5.25 ft. for narrower side flights.

222. Dimensions of Landings.

It is a rule for the landing, that its width is to equal the length of the step, or that of the narrower flight of steps in a staircase in two branches. But the depth of landing is to be proportional to length of stride, so that one may take two or three ordinary steps of 21.6 to 23.6 inches each on it. Only then will it make the ascent of the stairs easier, and it is therefore better to entirely omit the landing, than to insert it to the detriment of a proper rate of rise.

223. Lighting.

Lighting is of great importance for arrangement and appearance of the stairs, for a well lighted stairway makes an agreeable and charming impressi,n, just as a dark one produces an unpleasant and inharmonious effect. We naturally have then a feeling of insecurity in ascending or descending. Moreover the stairway usually serves also for indirect lighting of adjoining rooms. Therefore the stairway must under all circumstances have direct light and it should be lighted as abundantly as possible. The usual arrangement with the landing against an external wall causes the lighting of the stairway by side light,

the windows being placed at mid-height of the story, as in Figs. 299 and 300. This will therefore be made apparent properly by projecting the intermediate landing and stairway beyond the front of the building on the exterior; thereby obtaining more space for development of the design in the interior. But the windows of the stairway are not to be placed at the same height as those of the rooms; they should be placed above the principal landing and this should be against an external wall as in Figs. 301 and 302. For a landing or flight of stairs to cut across the glass surface of the windows is inappropriate and ugly.

In lighting by a skylight, it is to be remembered that if the staircase extends through several stories, intensity of the light in the lower story is naturally much reduced, and it is further greatly lessened by the shadows of the flights of stairs. As in Art. 207, not only must a plan suitable for admission of light be chosen, but the lighting surface must be made very large. Requirements frequently differ greatly and must therefore be obtained in different cases. In the staircases extending through the two lower stories of the Federal Capitol at Winterthur (Fig. 310d), the ground story is sufficiently lighted by the high side light passing down from upper stair hall through two openings in ceiling of lower hall, which together have an area of only 97.2 sq. ft., or about one-nineteenth of the floor area of the room. In the House of the Museum Society at Stuttgard (Fih. 309) the area of skylight amounts to 172 sq. ft. or about one-seventh, and is admitted through well-holes between middle and side flights of the stairway; the last example also shows how sky light may be utilized for directly lighting adjoining rooms. In designs for sky lights, care must be taken to provide sufficient ventilation of stairway in accordance with Art. 103.

224. Treatment of Forms.

Variety in architectural appearance and effect of the staircase is first fixed by the ground plan. The staircase ascending in a closed stairway appears different from that combined into a spacious design with the entrance hall, portico, or porch. The treatment of the staircase hall is also to be distinct from that of the stairway. Treatment of the forms is very varied, according to whether flights of steps are entirely free beneath or are supported by piers, columns, or vaults (For vaults beneath stairs and their decoration, see Art. 172, Figs. 228, 229) or are supported by walls at one end of the steps, or extens between entirely solid walls (box stairs).

It is less necessary to consider differences in form produced by construction and building materials, as these have been discussed and have been illustrated by the examples. The balustrade or railing always follows the inclination and the changes of the flights of stairs. This is aided by regarding

each flight as a part by itself; for even with a considerable length, the different steps only appear as unimportant architectural members; by their succession they aid one in estimating size of the room and height of ascent, the landing affording a necessary pause for the eye. The intersection of the flights and the inclined balustrade with the structural parts of the stairway occassions difficulties. It is simples when the flight of steps is built free in the room and ends there, and the pleasing and quiet impression thus produced is attained in no other way (Figs. 310b, 317a). If the staircase is built against one wall, the subdivision of the latter usually follows the inclination of the stairs. The wall surface is divided in panels and is also animated by moulded joints or by horizontal bands and mouldings ending at the height of the story. Smooth materials, capable of polish, and not easily injured by use, are especially appropriate therefor. If the flight must be carried along a series or piers or a colonnade which replaces the solid walls, it is advisable to treat the latter in accordance with its division into stories, disconnecting the strings and balustrades so far as possible. We should proceed thus, if as in Fig. 308, such free supports are required for supporting corridors or porticos which are frequently arranged around the openings for the staircase. Treatment of the forms is most difficult, when intermediate strings must be supported by piers or columns with or without inclined vaults connecting them.

When the stairs end at the height of the story, the upper portion of the stairway is sometimes freely developed above (Fig. 240), or is sometimes surrounded by the corridors. According to requirements, these are not only arranged on one or two opposite sides (Fig. 290), but usually on even three or four sides of the room (Fig. 311), and these not only serve for connecting surrounding rooms, but also have a very fine architectural effect. They afford charming views in the stairway and of the persons moving thereon. Especially in this upper part, the stairway is frequently treated as a kind of corridor and is then usually furnished with appropriate paintings and other ornamentation. The noblest architectural effect to be produced by combination of stairway and entrance hall has been most successful in numerous modern buildings, designed after older Italian models. This is shown by the Angerer Palace in Vienna (Fig. 307) and Technical High School in Munich (Figs. 310a, 310b) also Grand Staircases of the Opera Houses in Paris (Fig. 313), in Vienna, at Frankfort-o-M (Fig. 314), etc. That a derivation of motives from the Italian cortile contributed thereto is shown by the Grand Staircase in state hall of new Palace of Justice in Vienna (Figs. 317, 317a) and others.

Chapter 3. Desings of Courts.

225. General.

Like all other uncoverd parts of the site, courts have the primary purpose of ensuring light and air to the buildings. They further aim to arrange a connection of the parts of the building on the ground level. This end is served by this area, usually uncovered, laid out, leveled and drained. According to location, they are distinguished as fore, unner or rear courts, and according to importance and purpose, as main or side courts, light or kitchen courts, courts of the offices, stable yards, etc. The latter courts serve only for purposes of utility, chiefly occuring in residences and farm buildings, therefore needing no discussion here or more than reference to their treatment later.

But the design of the former is required by the architectural organism of the work and forms an inseparable part of the entire building, frequently being even an internal room therein, when entirely or partially enclosed by the building, and it is sometimes roofed. This kind of court, which belongs to the entrance and passage rooms of the structure, remains to be described as supplement to those. Its importance in architectural designing is self-evident, and this becomes more so by a brief retrospect of the historical development of courts.

226. Historical.

The temples of the Egyptians were furnished with spacious courts, enclosed on two, three or four sides, sometimes by single or even by double porticos (Fig. 318). These externally closed fore-courts removed the temple proper and sanctuary from the view of the people, but gave place in Greece to the open temple precinct, access to which (Fig. 319) was sometimes through a lodge with portico and magnificent portal, or a propylea. The court of a Greek house formed the central part of the building, of its life and activity. However simple and tasteless the exterior of the house, the interior must have been made rich and pleasing by its splendid effects of lighting, by picturesque views in the courts, animated by ornamental shrubs and plashing water, and by porticos with their splendid paintings and sculptures. The atrium and peristyle were usually small courts in Roman houses; several kinds may be distinguished, according to construction and arrangement, and they were furnished with a water tank, in which a refreshing fountain was placed when possible (Fig. 320). Noble courts were constructed in the baths of the Roman imperial period, partly as places for games, partly for other purposes, and they were furnished richly by statues and art works. These courts frequently ended in semicircular or segmental form and were generally enclosed by promenades or porticos.

The fore-court or atrium of the Early Christian basilica was usually surrounded by a portico and at its center stood a fountain for ablutions before entrance to the church. The atrium also served as a burial place (Fig. 321).

The mosques of the Arabs were also furnished with similar fore-courts. With these picturesque designs are included mediaeval cloisters. They were surrounded by buildings with cloister aisles in the lower stories, behind which were the halls and other rooms of the monastery. One of the finest examples exists in the Monastery of Maulbronn (Fig. 322); the cloister adjoins the north aisle of the church and is enclosed on the remaining sides by halls and other rooms of the monastery. But fortified courts of mediaeval fortresses and castles appear otherwise, but belong to a different subject, which cannot here be pursued further.

But it is especially in the creations of the Renaissance, particularly in the courts of palaces and other prominent Italian buildings, where must be sought models for present use and for transformation of these elements of architecture. Consideration of a few typical examples a will be useful in the following study of arrangement and treatment of courts.

a. Arrangement in General.

227. Location.

Courts are arranged in plan and elevation according to their purpose and to the conditions. The special purpose fixes the location before, within, or behind the building, then the formal treatment, and within certain limits, their space dimensions. The arrangement and treatment are different for a fore-court, from those of an inner-court; for a principal or state-court, or for a side or rear court. With regard to the relation of the court to the rooms for communication, in order to bring the staircase into convenient connection with the court, the corridor or entrance hall should open towards the court, and access to it is to be made as easy as possible. Side courts require separate entrances. Otherwise the location of the court and its connection with the plan depend on the form of the building, and it will here be only so far treated as required by a study of the design of courts.

228. Ground Form.

The rectangular plan is both simplest and most suitable. Yet, as in the following examples, polygonal, circular, elliptical, or other forms composed of straight lines sometimes occur. On irregular building sites, it is usually best to give the court a regular form. (Art. 235 and Fig. 333). The court is sometimes open on one or more sides, or bordered by promenades, and sometimes is entirely enclosed by buildings (internal courts). The surrounding parts of the building are also variously treated, being sometimes in one, sometimes in several stories. The chief purpose of most courts, the possibility of introducing abundant light and air, is naturally best fulfilled by having at least one side freely open for their admission. In many kinds of buildings, as in hosputals and insane asylums, prisons barracks, etc., no

other kind of court is permissible for sanitary reasons.

229. Dimensions.

Determination of its space dimensions is also of importance, especially in case of enclosed courts. If the buildings surrounding a court are very high and the court is not wide, sufficient light will not enter the lower rooms and the air stagnates and becomes impure in them. We therefore first consider the ratio of height to the width and certain minimum limits of these dimensions, not expressed in absolute numbers, but fixed with reference to climate and form used. Beneath the sunny sky of the South, shade and coolness are required, and in the inclement North, protection from wind and cold. Therefore much smaller dimensions suffice for the court in warm countries, than in cold regions, where it must be more open to the rays of the sun. It is generally assumed in Germany that the height of the building around the court should be about one-third the width of the court. This is only possible in rare cases and is only necessary, when the entire extent and height of the court are easily to be seen at a glance. Even then the given ratio is only to be taken as an average one. For a court arranged like a public square, serving for free entrance and surrounded by great monumental buildings, requires a greater width than that given. Thus the magnificent square court of the Louvre in Paris has for its side about 5-1/2 times the height of the lowest wing, built by Pierre Lescot under Francis I and Henry IV.

Yet a width equal to twice the height suffices for the court, when the observer can take a position to see perfectly and appreciate the entire architecture of the court facades. But this ratio is seldom attainable in inner enclosed courts. In Italy, where courts may be narrower, we find the width equalling or exceeding the height only in the grander designs. The proporgion of equal height and width appears to have been intended in courts of some noted buildings of the Renaissance period. These are sometimes square, sometimes rectangular, as in the beautiful courts of Giraud, Farnese, and Borghese Palaces in Rome, and that of Hospital d. Incurabili in Genoa, while they are sometimes higher than wide, the elegant court of Cancellaria in Rome having the ratio of about 8 to 7, and the court of Strozzi Palace in Florence that of about 8 to 6. But in most Italian courts, the width is only from 3/4 to 1/2 the height, or even less.

As for the absolute dimensions of height, from observations in different acceptably lighted courts and from comparison, in Germany an architecturally treated court with minimum sufficient lighting should have a clear width of not less than 29.5 ft. to 32.8 ft. with a height of at most 39.4 to 52.5 ft. The eye can here see but a portion of the interior at a glance. With so great a height, it is necessary that light entering through glass roofs should in

nowise to be obstructed by the structure of the roof.

230. Section.

For courts enclosed by high buildings, the arrangement in Fig. 223 is also employed for better introduction of light by making the court larger at the top. If the court be rectangular, its ends may be higher than its sides; the given proportions may be approximated in this way.

b. Enclosed Courts Partially surrounded by Buildings.

231. Fenced Courts.

Permanent enclosure of a square makes it a court; access is obtained through gateways, and within the enclosure or in direct connection therewith is the building. According to the mode of enclosure, these courts are capable of the most varied treatment. Where the court adjoins an open square or street, the enclosure consists of a wall with or without entrance gateways, and where there is no wall, it has an enclosing fence of metal, either iron or bronze, of monumental design. Piers and columns supporting vases, spheres, etc., are placed at suitable intervals to decorate the fence, and their forms must be suited to the architecture of the gateway. The portal and carriage entrance are sometimes treated like a triumphal arch or frequently as deep gateways with living rooms for the gate-keeper (Fig. 259).
Decorations appropriate for open squares, such as columns, obelisks, statues or groups, fountains, etc., are equally appropriate for large courts of this kind. Where several courts adjoin, merely an open grille is generally preferable for separating them; the impression must be that of a single court divided into several parts. For a separation, as well as to enclose the court, instead of a solid wall or open grille, porticos are arranged on one or more sides, especially on the front side and they are left open on both sides or are enclosed by an external wall and left open next the court. Courts arranged thus occur in many buildings of antiquity and in recent structures, the latter being attached to casinos, to exhibition buildings with promenades, etc. A most notable example of a large court surrounded by porticos is that of the National Gallery in Berlin (Fig. 324). The temple-like appearance of the building and of its entire surroundings is made especially effective by the design of the court. Taken in this sense, architecturally treated cemeteries should likewise be considered as courts surrounded by portico-like passages, walls against which monuments are built, etc.

232. Fore-Courts.

But courts are not usually enclosed on all sides by mere fences, buildings adjoin them on one or more sides. This is the frequent arrangement found in palaces, noblemen's seats, etc., where instead of placing the main building directly on the street, it is set between the court and the garden. Low

front buildings sometimes form the enclosure next the street or the passage to the facade, Fig.325, but wings or subordinate buildings generally enclose the court on both sides, Figs.327,253, while it is enclosed on the other side by walls, grilles or porticos. In designs of larger buildings, besides the principal court, several lesser courts are provided, mostly for servant's use. The advantages of this design, such as quiet location, distinguished external appearance of the principal building, etc., are evident.

A still greater heightening of effect, peculiar to some French palaces of the end of the 16th century, is produced by arranging several successive courts, flanked by buildings on both sides, widest next the square or the street, and diminishing in width towards center of main building. The court of Palace of Versailles is executed thus with an extremely dignified and beautiful effect (Fig.328), however monotonous its architecture may be in other respects. To the Chateau of Louis XIV(byMansart), we pass through a great fore-court enclosed by a rich grille, at the sides being two buildings originally intended for ministers (Court of Ministers). A second court succeeds (Court of Princes), then a third and still narrower court, which again leads to the last and smallest court(Court of the King), next which were placed the sleeping apartments of the King.

233. Rear Courts.

Quite a different character, more attractive if less pretentious, is produced by having the court extend behind the principal building, instead of before it. We first consider thae arrangement introduced in Italian villa architecture, especially in Florence and Rome, where the court is combined with gardens. This is illustrated by the Villa Albani.(Fih.199) Another beautiful example is the court of Pitti Palace (Fig.328). In the background is placed the entrance to a more elevated garden, in a grotto-like niche being a fountain. The ascent to the garden is by means of steps winding around the grotto in quadrant plan; in the middle is a landing, from which another straight flight leads to the top. A court design of highest elegance is at the charming Villa Pia in the Vatican. Fig. 330 is its ground plan; Fig. 329 is a view of the oval court forming a terrace. In the rear and at one end of the smaller axis is the Villa, in front and at the other end being a portico opening along its sides by colonnades. This is externally in two stories and rises from the lower part of the design in the middle of a basin, down to which one may descend by ramps from two small and lofty portals flanking the terrace court. Courts of most palaces in Genoa have low buildings at the rear or open directly into gardens, which enrich the courts by special decorations and are also usually raised higher than the level of the court, thereby affording oppurtunity for decorating the rear of the court by terrac-

ed slopes and fountains. Where conditions of the ground permit, one should never fail to realize such advantages.

c. Enclosed Uncovered or Glazed Courts.

234. Courts with Porticos.

In this kind of court must be clearly retained the distinction in Art.225 between courts for useful purposes and those serving both convenience and luxury. We will consider the latter. They are like the atrium of the antique house and are considered as an inner room thereof, if the rooms of the house open freely into the court or are connected with this by porticos surrounding it. While for fenced courts, or those but partially surrounded by buildings, walls, grilles, and porticos chiefly occur as enclosures; in internal and covered courts, they usually extend around one, two or more sides in each story so as to form a connection with the interior. This design was especially favored by the climate and acquired a typical importance as a cortile in Italian buildings.

235. Ground Plan.

Its addition to the ground plan gives rise to very different forms of plans, Figs.331 to 337, which especially differ in their connection with entrance, and in the location of entrance, entrance hall and stairway. The staircase sometimes commences directly in the entrance hall before the court; it sometimes leads directly into it, and may lie at one side or on the main axis at the rear of the plan, etc. In the last case, it belongs as much to the court as to the adjacent parts of the building, and it is generally arranged in two branches in the buildings of the best Renaissance period and in later examples. These Italian models were imitated in many courts of the Renaissance period in German free imperial cities, connected with the South commercially (Figs. 334 335). Like analogous French and English examples, these were modified to suit climate and customs.

236. The Elevation.

The elevation of this court with porticos and galleries corresponds to the division into stories and generally exhibits several stories of piers or columns of different orders set above each other, sometimes connected by horizontal entablatures or by arches, an arrangement, whose application to the exterior of the building has already been described in Art. 192. Loggias or galleries in the highest story usually have a colonnade with horizontal roof, while the lower stories have arcades. The reverse arrangement also occurs. In the first case, to retain the axial distances of lower story causes some difficulty, since colonnades with horizontal entablatures like the antique produce very wide intercolumniations. To avoid this defect, the colonnade sometimes extends through the two upper stories. This does

not a give a truthful impression of the internal arrangement and is scarcely to be used in court designs, since the proportion of the upper order of columns then require such a distant point of view for the observer, that it can almost never be obtained in inner courts.

But the arrangement in Fig. 338 is occasionally found, as in the court of Monastery St. M. della Pace in Rome, where on the lower arcade piers stand the cross-shaped piers of the upper story, their intervals being divided by slender columns, which merely subdivide the openings like window mullions. Still more commonly, especially in Tuscany, the upper openings are entirely undivided and the columns are spaced with wide intercolumniations corresponding to the lower axial division; but instead of the stone architrave, wooden beams are placed above them with strongly projecting cornices supported by rafters. This arrangement is an entirely proper structural one and satisfies esthetic feeling, since it is based on the lighter forms of wooden beams.

We have to mention courts surrounded by porticos at the ground level, their upper stories being enclosed. All such courts are very appropriate for reception of monuments, ornamental fountains, statues, sculptures, and of colored decorations even if in a limited degree. Without abundant means, we may at least create a view from the entrance hall into the court, and enhance the picture by planting this with ornamental shrubs, by designing a fountain or a niche with a figure or vase, on the axis through the entrance, which are motives seldom omitted in an Italian house.

237. Glazed Courts.

To accord with their primary purpose, courts shall be freely open and especially uncovered. Thus were they alone employed down to the most recent period. Yet courts surrounded by galleries, if constantly exposed to wind and weather, are not as well suited for ordinary use in colder nothern countries, especially for comfort and ostentation, as is the case in warmer southern regions. Therefore open loggias or galleries, which surrounded the courts of older Renaissance buildings, were later mostly enclosed (Art. 187), and they were almost entirely omitted in the works of the following period. Glazed corridors or entrance halls were introduced in their place. Men learned to treat courts enclosed on all sides without porticos and galleries, like the external architecture, and to give them a richer decoration and characteristic expression. This appears in the court of Louvre in Paris, the court of Old Royal Place in Berlin, etc., whioh have the greater area required for such treatment.

238. Glass-Roofed Courts.

By progress in all technical branches, men have been enabled in recent times, to entirely cover large sized courts with iron and glass, effect-

ively protecting them from injuries by the weather, and also supplying adjacent parts of the building with the necessary light. Ventilation is usually effected in glass-roofed courts through openings in their sides and roof, but it is sometimes materially aided by heating apparatus. The roofing and warming of inner courts not only produce greater comfort for the occupants, an advantage in cold countries not to be underrated, since alternate warming and cooling of external walls almost entirely dissapears, reducing loss of heat to a minimum, but heating of the internal rooms of the building is made easier and relatively cheaper. It has thus become possible to give courts of more recent buildings both an importance and such a treatment, without detriment to their main purpose, that they may be made approximately equal to the noble designs of antiquity and of the Renaissance period.

The structural organism and the treatment of forms are essentially the same as in those models, and the portico has particularly come into use. Differences in arrangement and treatment are produced by the varied purposes of our courts. Those courts are preferable found in buildings intended to fulfil the requirements of the modern era for purposes of trade and business, for public purposes, for assemblage of great numbers of men, etc. Their use is especially common in banks, post offices, railway stations, hotels, and places of amusement; also in court houses, legislative buildings, city halls, and frequently in school buildings, etc.

We have here to distinguish the following:-

a. The glass-roofed court, open to common use and accessible by carriages as in some hotels (Fig.228); it then forms an enclosed pyblic square or place, which usually has the same character as the architecture of the streets and is paved or asphalted.

b. The festival, state or show court, like a hall with a sky light, and thus really used as an internal apartment of the building, as in Austrian Museum of Art and Industry (Fig.337) in Vienna, hotel "Kaiserhof" in Berlin (Fig.338), Arsenal in the same city, Technical High School (Fig.310e) in Charlottenberg. The porticos and galleries of the court then combine with the entrance hall and stairway, are designed in harmony with internal treatment of the building, and are treated like rooms for communication, being decorated by mosaics, marble slabs or tiles or even as a kind of winter garden. If the staircase is built free in the court, (Fig.317) it may be designated as a stair-court.

c. Like market and business halls, the court may serve as a bazaar and be

surrounded by shops, vaults and warehouses; or it may be used as an exchange and exhibition hall and be correspondingly treated, as in House of Architect's Society in Berlin (Figs. 339, 340), where the court is surrounded by galleries in the two upper stories, communicating with adjacent apartments.

The last two classes generally require the entire ground area of the court only in the ground story with but moderate height, corresponding to its width and length. The glass roof then includes the second or third upper story, but this does not prevent it in certain cases from occupying the entire height, or the glass roof proper may be arranged above the roof surfaces of adjoining buildings. Here belong smaller and larger designs, whose lower stories are used for business purposes, usually as glass-roofed apartments, but their upper stories merely serve as light courts and sometimes have galleries. This makes it possible sometimes to utilize the corridors on the ground level as covered rooms, over a part of these introducing into upper stories the required light and air. Many notable examples are found in business buildings of the modern period. Other important court halls, as those of court houses, post offices, city halls, etc., belong sometimes to one, sometimes to another of the forms mentioned above, everywhere manifesting variety in purpose by the arrangement, construction and form.

Chapter 4. Designs of Large Halls.

239. General.

Every large internal room enclosed by walls and ceiling is termed a hall, whether it forms a separate structure or is an essential portion of the building. Many halls, especially those of extraordinary dimensions, are often briefly designated as "Halls", especially when they serve for general purposes. In nearly all prominent buildings for public and private use, the hall occurs with greater or less dimensions, sometimes as a room for general use, sometimes as a state apartment opened to a larger circle of visitors on festal occasions. Therefore the hall will be considered as the last, though not the least of the rooms comprised in this Division.

a. Typical Forms of Halls.

According to the special purpose they are to serve, halls exhibit great diversity in detail and in general in their forms. But certain principal kinds may be distinguished, and their types may ever be found in the noble buildings of antiquity.

240. Antique Basilicas.

The elongated building of simple rectangular plan first acquired great importance in the antique basilica. This became the motive for churches, cathedrals, and for numerous halls, in the later periods. The basilica is refered to Grecian origin; from descriptions of royal halls at Athens and in oth-

er cities of Greece by Grecian writers, we may assume a certain similarity of their design, to the Roman basilicas. The name basilica was first applied by the Romans to covered halls adjoining the Forums, which served for meetings of merchants, for sittings of courts of justice, and for public business of all kinds. Yet Roman basilicas are not built after a generally accepted model, any more than any other kind of buildings. The remains of pagan basilicas vary from the rules given for them by Vitruvius.

However it may have been with details of the design, it now appears to be settled that the Roman basilica was a rectangular hall, probably with closed sides, and usually with such a width that to cover it, it was divided by rows of columns or piers into three or five aisles. The middle aisle then was considerably wider than the side aisles (three times their width according to Vitruvius), and was almost always higher, so that a high side light could be introduced into the center aisle over roofs of side aisles. Galleries were usually arranged over side aisles, the upper columns being lower and with high balustrades next the center aisle. On the main axis and usually at one end, though sometimes on the side, was a raised space enclosed by balustrades, the tribunal, which usually took the form of a circular or polygonal niche. Subordinate rooms frequently adjoined this. The basilica was generally covered by a horizontal ceiling, but was also vaulted.

The Basilica Julia in Rome was of large dimensions (Fig. 341) and may be taken as a type of the true commercial basilica, but the Basilica of Constantine in Rome (Fig. 342) is to be considered as the type of an antique state hall. The former is characterized by the omission of a tribunal niche and by the existence of numerous subordinate rooms along the longer side of this five-aisled basilica with piers. Worthy of note in the plan of the Roman basilica is especially the extending of side aisles around all four sides. It is evident that the Basilica Julia could have had only a horizontal ceiling. Not less characteristic is the Basilica of Constantine, whose center aisle is covered by a colossal groin vault of 82 ft. span, divided into three bays, the side aisles being covered by three tunnel vaults at right angles to the axis. Their abutments recieve the thrust of the groin vaults; below their springing points were arranged projecting columns.

241. Halls of Baths.

Next to antique basilicas are the magnificent halls of the Roman baths, which have the same expression as the former. The same arrangement of the former. The same arrangement of the Basilica of Constantine is found in Baths of Caracalla and in those of Diocletian in Rome. Fig. 231 represents the principal hall, just as noble in effect as appropriate in construction. This makes possible vaulting instead of a wooden ceiling, securing a decid-

ed advance in architectural treatment. The vaults of middle aisle rose so high above the side aisles, that as shown by the illustration, the hall was lighted by high side lights above side aisles.

242. House Basilicas and Halls.

These examples show that the Romans knew how to develop the basilica and transform it into a state hall. As such, not only in palaces for monarchs, but also in private houses for festal gatherings. Some data on designs of Roman halls are given by Vitruvius, who distinguishes in dining and other halls be tween Corinthian, or halls with four columns, and Egyptian halls, for he describes the former as having a vaulted ceiling over simple colonnades, but gives to the latter two colonnades above each other, covering them by an ornamental coffered ceiling with windows between the upper columns. In regard to halls for paintings, it is only stated that like halls for speaking, they were larger. Halls for speaking in gymnasia were large open halls attached to colonnades and furnished with seats, so that philosophers could give instruction to or amuse an audience.

243. Theatres and Amphitheaters.

Quite different from these halls, from antique house basilicas and commercial basilicas, were those mighty creations of the Greeks and Romans, the theatre and the odeion, the amphitheatre, the hippodrome, and the circus. Although without roofs, or only covered by an awning, they should not be neglected, since they are typical forms for our designs of halls, nearly relating to them in purpose and form, and are also the architectural works, where the circular building came into use in the most imposing manner. They differ in arrangements due to their uses, so that sometimes semicircular or circular plans appear most suitable, sometimes oval or a more elongated plan. In varied and entirely enclosed rooms, the circular building sometimes produces a peculiar effect in noble works.

244. Centralized Buildings and Church Basilicas.

A very remarkable transformation of this leading form occurred in Early Christian art, especially in ecclesiastical architecture. From Roman state buildings and monuments of the later imperial period was derived the centralized buildings in Byzantium under the influences of oriental architecture, and in the West were produced the basilican churches, doubtless by transformation of the pagan basilicas for Christian worship.

Since we do not have to consider church architecture here, it will only be necessary to refer to the centralized or basilican form of church, so far as in its chief peculiarities may be recognized elements of forms of halls in secular architecture.

In centralized buildings, the peculiar ground form is at once apparent,

and it is sometimes composed of a regular polygon, sometimes is in form of a Greek cross with merely nave and transepts, or (Fig. 342) consists of a primary square with outer aisles and semicircular apses. The subordinate buildings in Fig. 342 are also noteworthy. The architectural treatment receives extremely effective and characteristic expression by the superstructure, manifested in varied grouping of the principal dome rising above the whole, as well as in vaulting the aisles and corner buildings in two stories (Figs. 58, 63 to 66).

The arrangement of the Early Christian basilica was at first like that of the pagan basilica, but gradually deviated more or less in construction and plan. We may emphasize as essential changes and extensions architecturally, the prefixing of the atrium, the occurence of transepts with or without a dome over the intersection, the projection of the apse and the development of the raised choir, the later addition of towers, etc. So far as the interior is not vaulted, the ceiling has coffers, is ceiled, or the frame-work of the roof remains visible.

245. Mediaeval Halls.

With this reference to eclestiastical architecture, it should not be said that forms of halls in secular architecture lacked separate development. Especially in the middle ages, the perfecting of vaulted construction exerted a great influence upon treatment of the hall in the palace and in the monastery, in the castle and in the city hall, even though wooden beam ceilings and visible roof trusses remained in use as before, both for covering very wide halls and for lower rooms, where vaulting did not seem advisable or necessary.

The growing community felt the continually increasing importance of city affairs, and of the ecclestiastical orders, and required new buildings with great halls, which the masters of Gothic architecture knew how to adorn with great beauty and elegance. New motives and charming art forms were produced in stone, wood, and bronze, with no really new ideas in construction. Only the mode of lighting can be so designated, in halls of wide span. In case of vaulted ceilings, this was by means of large pointed windows, crowned by external gables, which intersected near the top of the vault. With wooden ceilings the light was introduced through luthern windows, sometimes between the visible trusses,, sometimes through sky lights in the wooden ceiling, which was usually of semi-cylindrical form. The usual arrangement of windows for low side light was in most common use, both for vaulted halls and for those with wooden beam ceilings.

246. Halls in Renaissance and Modern Periods.

The architecture of the Rens issance is also inexhaustibly rich in this

respect, not only in fanciful ornamentation, but also in refined development of construction and forms of halls. They were indispensable to every prominent building; according to Palladio, "like public places, which serve for festivals, feasts, presentation of comedies, weddings, and similar amusements, they are therefore larger than the others; and must have that form best suited for many persons to comfortably occupy them and see the proceedings". If this primarily means the hall, which " all well arranged houses have in their central and finest part," it no less relates to halls in the palace and the villa, as well as to well known large halls of Italian municipal buildings and courts of justice, and to old city halls, commercial halls, pleasure houses, etc., in Germany and other countries.

But the modern period makes the most extensive use of halls. For in every sphere of life, in the state and in the community, in art and science, in trade and travel, in the great world and in simple family life, the restless activity of civilization has created new arrangements and improvements and caused new needs and views, embodied in new works of architecture. The design of halls is always of decisive importance. As in older models, designs of halls now produce the principal types of the basilican, and of the centralized building, the latter being subdivided into polygonal, circular, and cross forms. It remains to examine how these transmitted forms harmonize with the aim and purpose of our buildings.

a. Arrangement and Form of Halls.

247. Classification of Halls.

To whatever kind of buildings halls may be attached, they may be subdivided into the following groups, according to the chief purposes they are to serve:-

I. Halls for the purpose of seeing and hearing well.

II. Halls for assemblies, festivals, exhibitions, etc.

III. Halls best adapted to fulfil all these purposes.

The arrangement and form of halls are therefore generally subject to one or more of these requirements, and to the conditions of the problem. The design of the second kind of hall admits of greatest freedom, and that of the first has the least; limitations also extend to halls of the third group. If a room completely fulfils the requirements of good hearing and seeing, it will not generally be difficult to satisfy all other requirements of the design.

1. Limitations of Space and Main Form.

248. Acoustic and Optic Center.

An acoustic and optic center exists in halls intended for good hearing and seeing. In halls for lectures and addresses, it is indicated by the speak-

er's desk; in concert and theatre halls, it is located in the orchestra, or on the stage near the foot-lights. In designing a hall, it is necessary to commence at its acoustic or optic center, and the plan or arrangement of the auditorium or space for spectators are made afterwards. It is evident that an arrangement suitable for the space for hearers or spectators differs much from those suited for the acoustic or optic center, or for the stage. Distinct perception of tones or of the object to be seen by direct rays is only possible within a limited distance from the source of sound or location of the object. These limits are therefore of supreme importance in halls of this kind.

249. Limits of Good Hearing.

The limits of good hearing in the quiet open air have been fixed by experiment. Without further discussion we refer to Fig. 344, where these limits are graphically represented, assuming the speaker to be placed at C. The full line indicates the limit for good hearing in all directions from the speaker in accordance with the well known experiments by Saunders; those of Henry do not materially differ. On the basis of those and similar results, Orth and also Favaro give the simple form of a circle of 131 ft. diameter drawn through points respectively distant 98.4 and 32.8 ft. from the point O, as a limiting line with equal intensity of sound. Even if only approximately correct, yet for our purpose this circle is a sufficiently accurate representation of the limit.

Although diffusion of sound is quite otherwise in an enclosed hall filled with people, than in the quiet open air, where the observer is disturbed by no one, though the influences which result are partly beneficial and partly injurious to distinctness of perceptions of tones, we must accept these results for lack of other data. These are then the limits of good hearing, when the effect of the voice or the tone is not strengthened by artificial means. When these are employed, the limits may be extended much further; but they are to be made much less, if injurious effects of sound are produced.

250. Ground Form of Hall.

The form of space for the audience is derived from the preceding, together with other laws for diffusion of sound. The more closely this form approximates to these distances and limits, within which the voice is heard in all directions with approximately equal distinctness, the better will the room be adapted for good hearing. It follows that the most suitable ground form for halls of this kind is that approximating a circle, after the model of the Grecian theatre, which is chiefly enclosed by a circle. Starting from this basis, the ground forms in Fig. 345 were developed. Beyond the limits of good hearing, the tones are no longer distinctly perceptible by direct

rays and the form is determined in accordance with the influence of the enclosing surface of the room upon diffusion of sound. The same is true of the examples in Fig. 247.

251. Acoustic Niches.

In most intimate connection with the form of space for the audience is that of the locality of the source of sound. This purpose usually is served by a particular space, freely open toward the audience, of a form adapted to give to the sound rays a certain impulse and a certain initial direction, at the same time strengthening them. This may be termed the acoustic or sound niche. Such an extension of the room does not always occur, because the acoustic center is located within the hall itself; either since the addition of a sound niche is usually not practicable, the hall being not exclusively intended for the purpose of good hearing; or for the mode in which it is to be used, a simple platform or a speaker's desk is more appropriate.

252. Other Means for Good Effect of Tone.

For better effects of tones, the enclosing surfaces of the room are to be so formed and so limited, that useless dispersion of sound waves into empty space is prevented, and their reflections may have a beneficial effect. All space unsuitable or superflous for the purpose of hearing is injurious and is therefore to be omitted in designing the hall, since sound waves would be uselessly dispersed; material and form of the surfaces of the ceiling are to be so chosen, that they may be made useful to the effect of sound (vibrating surfaces placed near the source of sound), and that reflected sounds may be neutralized. For this reason, the most suitable form for lecture halls of moderate size is a quadrant, described from the position C of the speaker, instead of the more common form of hall enclosed by a semicircle; the omission of two circular sectors is therefore recommended, where seats are not desirable. Executed examples of both ground forms are given in Fig. 345. Yet in very large lecture halls, the angle at the center of the first ground form must be materially greater; the angles of the circular sector must also be cut off parallel to the middle axis.

If the preceding principles are decisive in fixing limitations of space for halls of moderate extent, they are much more so in halls intended for great numbers of persons, and which must therefore extend beyond the limits of distinct hearing. If the sound niche is omitted, then by other artificial means (reflector, sounding wall, sounding board) uniform diffusion with intensification of sound near its origin are to be produced. To prevent echos, the use of non-reflecting materials for the most distant parts of the room is to be recommended, as well as to avoid smooth surfaces, the arrangement of forms to disperse sound, recessing and rounding off angles of walls and

of ceiling, etc.

253. Requirements for Good Seeing.

The acoustic requirements of halls have so far been treated by preference, and even if these have not been exhausted here and must be mentioned later, good acoustics is not alone decisive, but other requirements are now to be discussed. For in nearly all cases, a solution of the problem depends upon a happy combination of different properties required in a hall with reference to its purpose. The demand for distinct seeing is in many cases to even precede that for distinct hearing. For many halls are intended only for the enjoyment and perception of the eye, and not for those of the ear(hippodrome, circus, panorama, etc.). If optical requirements have so far been subordinated, this is because they are more simply satisfied than the acoustic, though both usually coincide.

The last is true with the limitation, that in a room where one sees well at all points, he generally hears equally well, though not always the reverse. For one may hear without seeing the source of sound, and with a suitable design of the room, the reflected sound rays also add to the better effect of the sound. To be able to see an object, no obstacle can exist between it and the eye of the observer; the visual aray must pass directly to the object. Even then optic requirements are more easily fulfilled than acoustic. The limit of distinct vision is more restricted than that of distinct hearing. It is usually given at 39.4 ft. from the object, or at 26.2 to 29.5 ft. where very clear vision is necessary, as in school rooms. Yet it is usually not required to restrict limits of space to small dimensions, since many exhibits are calculated for the use of opera glasses, and absolutely distinct vision is not generally demanded by others.

254. Diversity in Arrangement.

In many halls for public assemblies, as in churches, it is entirely sufficient if but a limited visual angle is open to each person with a possibility for him to conveniently see the pulpit and the speaker. The distance from the eye may then be considerable. Therefore these halls generally have a rectangular nave; hearers are distributed over the floor of the hall, and the speaker occupies a place more or less elevated, since he can thereby be visible and be more easily understood at a greater distance.

In lecture halls, legislative halls, etc.,the requirement of distinct vision is scarcely less important than that of distinct hearing. For a large room, darially arranged seats are indispensable, since the eye can then be directed exactly on the object; especially in halls for experiments, where the limiting distance cannot be made great. In rooms of moderate breadth and length, slightly curved or even straight seats are sufficient. The platform of the speaker is usually somewhat higher than the lowest of the usually as-

cending rows of seats. But for very accurate vision, the object viewed must not be raised higher than the eye of the observer on the lowest row of seats.

In court rooms, the requirements of distinct vision and hearing vary for different parts of the hall, especially for the various persons engaged in the court proceedings and for the public. In theatres, the entire stage must easily be seen.

If these conditions primarily affect the internal arrangement of the hall, they likewise have great influence on the arrangement and form of the building. Just as in antique theatres, the arrangement of steeply inclined rows of seats in halls is a characteristic element of the structural organism, upon which depend not only the optic, but also acoustic properties of the room. The inclination of rows of seats may not be on a straight line at pleasure, but in a curve, concave upwards, constructed to scale and in accordance with actual horizontal and vertical distances of acoustic or optic center from the eye of the hearer or observer (Isacoustic Curve).

2. Arrangement in Detail.

On the preceding principles are based the limitations of extent of space and the forms of halls, although only in outline. But we will now contrast halls of Group I for good hearing and seeing (Fig. 345) with halls of Group II for assemblies, festivals, exhibitions, etc. (Fig. 348), and with those of Group III (Fig. 347), which serve for all these purposes, and we will then compare them, while briefly treating of other requirements of their design.

255. Lighting.

The lighting of the hall is most intimately connected with the demands for distinct vision. So far as natural lighting is concerned, everything necessary has already been said in Art. 103; the lighting of museums, halls for collections and exhibitions, as well as that of courts of justice and of other halls, will be discussed in later volumes of this "Handbuch". But in many halls natural light is less important than artificial, and the decorative subdivision of the ceiling depends on the arrangement of the lighting fixtures. Some other factors influence the arrangement and form of halls and only require to be suggested here.

256. Proportions and Dimensions.

As for the ratio of height, width, and length, these have no less influence on the acoustic, than on esthetic effect of the room. From diversity in ground form, these relations can only be fixed in each case. It may be said in general that not only relative, but also to a certain degree, absolute dimensions are of importance. Height of the room should not be too great, since an echo might otherwise be produced (Art. 100, rule 8; very suitable for large halls).

cending rows of seats. But for very accurate vision, the object viewedmust not be raised higher than the eye of the observer on the lowest row of seats.

In court rooms, the requirements of distinct vision and hearing vary for different parts of the hall, especially for the various persons engaged in the court proceedings and for the public. In theatres,the entire stage must easily be seen.

If these conditions primarily affect the internal arrangement of the hall, they likewise have great influence on the arrangement and form of the building. Just as in antique theatres, the arrangement of steeply inclined rows of seats in halls is a characteristic element of the structural organism, upon which depend not only the optic, but also acoustic properties of the room. The inclination of rows of seats may not be on a straight line at pleasure, but in a curve, concave upwards, constructed to scale and in accordance with actual horizontal and vertical distances of acoustic or optic center from the eye of the hearer or observer (Isacoustic Curve).

2. Arrangement in Detail.

On the preceding principles are based the limitations of extent of space and the forms of halls, although only in outline. But we will now contrast halls of Group I for good hearing and seeing (Fig. 345) with halls of Group II for assemblies, festivals, exhibitions, etc. (Fig. 346), and with those of Group III (Fig. 347), which serve for all these purposes, and we will then compare them, while briefly treating of other requirements of their design.

255. Lighting.

The lighting of the hall is most intimately connected with the demands for distinct vision. So far as natural lighting is concerned, everything necessary has already been said in Art. 102; the lighting of museums, halls for collections and exhibitions, as well as that of courts of justice and of other halls, will be discussed in later volumes of this "Handbuch". But in many halls natural light is less important than artificial, and the decorative subdivision of the ceiling depends on the arrangement of the lighting fixtures. Some other factors influence the arrangement and form of halls and only require to be suggested here.

256. Proportions and Dimensions.

As for the ratio of height, width, and length, these have no less influence on the acoustic, than on esthetic effect of the room. From diversity in ground form, these relations can only be fixed in each case. It may be said in general that not only relative, but also to a certain degree, absolute dimensions are of importance. Height of the room should not be too great, since an echo might otherwise be produced (Art. 100, rule 8; very suitable for large halls).

Otherwise, by the construction of rows of seats and of galleries, as well as by niches and other extensions, the ground form of the room is as much changed as its acoustic effect. In halls of Group I, Fig. 345, formed after the model of the antique theatre, so that all sound may pass radially and directly to the ear, the seats are generally stepped, being partly in rows above each other. The height may be tolerably great if the ground surface is of moderate extent.

257. Designs of Halls.

Besides examples already mentioned, and the lecture hall of Midland & Birmingham Institute and Hall of Deputies in Palace of Legislative Assembly in Vienna, the following are characteristic typical forms; the Scala in Milan, one of the grandest theatre interiors, famous for its accoustic properties, hall of the Trocadero Palace in Paris, which holds about five thousand persons, and Albert Hall in London, intended for eight thousand, or ten thousand with the highest gallery. Even if defective in acoustic relations, when compared to halls of oblong ground plan, they prove it possible to build halls of this type on the principle of direct radiation of rays, which can contain twice as many persons as a rectangular room, where one is partially compelled to rely upon indirect transmission of sound.

The Albert Hall (fig. 345) has the proportions of about 3 : 4 : 5 and is entirely lighted from the ceiling. The concave glass area of about 138 ft. by 174 ft. and the considerable height of about 131 ft. would produce very disturbing effects of sound, were it not that the velarium (awning) is made in convex form and of solid materials (Fig.348). To this arrangement and also to wooden wainscoting of enclosing walls of orchestra and galleries is chiefly to be ascribed the satisfactory effect of tone found in the building, both when moderately,or completely filled. These properties are not possessed equally by the festal hall of the Trocadero, although considerably smaller, unless Garnier's expression has become true since it was opened (1878), " that halls eventually become like wine in bottles". The large hall of the new Cloth Hall in Leipzig (Fig. 345) only at its ends extends beyond Arth's limit of distinct hearing. By its form it belongs to the examples in Fig. 346; the proportions of height, breadth and length are 3 : 4 : 8.

In halls of unusual size, especially in those of Group III, and which must be adapted to purposes of the most diverse kinds, the ground form is generally that of a rectangle. Their form is much changed by cutting off or rounding the corners, the ends frequently terminating in circular arcs, etc. These forms are designed to carry the sound further in its initial direction, and the width is accordingly almost always considerably less than the length. This is seldom less than 1 1/2 times the width; the ratio of approximately 2 to 1

more frequently occurs, and even that of 3 to 1 is sometimes reached (Fig. 347). But the height cannot be very great. The lower the hall, the less will be the danger of disturbing effects of sound. The ratio of "height equal to width(measured between enclosing surfaces)" appears to be the limit, which can be reached only in halls of moderate or small absolute dimensions, and can scarcely be exceeded.

Since these halls not only serve for oratorical, musical, and theatrical uses, but also for festal assemblies and for other purposes requiring the free use of the room, the floor of the hall is made horizontal. Yet platforms are usually arranged along the walls, as well as projecting balconies, rows of seats, or galleries, and the latter are either built free, as in the large hall of the Building of the Musik Verein in Vienna (Fig. 349), or they extend to the ceiling of the hall. The latter arrangement frequently occurs with a division into three aisles, and sometimes with one in five aisles (Festival Hall in Carlsruhe; Central Hall of Alexandra Palace in London, Fig. 347) This is substantially the basilican form of hall, where side aisles are in height chiefly divided into platforms and galleries for spectators and auditors. The lower parts of the aisles sometimes serve for communication and lie outside the main hall, as in the City Hall in Mayence (Fig. 350); the gallery is sometimes omitted above and there is only the lower passage, as in the hall of Bourse in Vienna (Fig. 352). Smaller halls of this kind mostly have neither passages nor galleries, or only one at one end. Such an example of important extent, is the winter garden of Central Hotel in Berlin (Fig. 347); proportions being about 3: 14: 13. Among German designs of halls, this one covers the greatest clear floor area without intermediate supports, even though the Clear span of City Hall at Maintz is much greater.

A peculiar form is shown by the concert and festival hall of Casino at Ostend (Figs. 351, 347) but which certainly cannot accord with the requirements of acoustics; at least its arrangement and form in general, as well as location of the sound niche, permit us to assume the nature of the glazed enclosing surfaces, etc. In a few cases, the sound niche, (if used) is placed at the center of the longer side, but it is otherwise always arranged at the rear end. In the designs of halls in Group II intended for assemblies, festivals, exhibitions, etc., one is naturally less restricted, and Fig. 348 shows that all typical forms of halls indeed occur; the choice is partly at pleasure and partly determined by local conditions, and by the requirements of the problem.

As an example of a simple elongated building, the hall of Palazzo della Ragione in Padua may serve, one of the largest halls in Italy, with approximate proportions of 1 : 1 : 3. The new Vienna Bourse is a basilican structure of very noble dimensions with proportions of about 4.5 : 5 : 11. The Glass Pal-

ace in MUnich, used as a hall of the largest size for the past ten years, is five-aisled and arranged in cross-form. The same form appears in the relatively very small hall of Hotel Frankfurter Hof at Frankfort-o-M. The festal hall of City Hall in Berlin again has the rectangular form with a single gallery along the longer side, and proportions of about 1 : 1 : 2. A circular building of vast dimensions, the largest clear internal area now existing, is found in the rotunda of Vienna Exposition of 1873; it properly received a relatively low height with a ceiling of conical form. Another circular design of very imposing diameter is the reading hall of the British Museum in London, not intended for acoustic effects and covered by a great dome. The same is true of the small though beautiful rotunda of Old Museum in Berlin (Fig. 352). A notable example of a tetrastylar design with elliptical niches occurs in the reading hall of National Library in Paris (Fig. 358).

258. Dimensions.

Figs. 345 to 347 give dimensions of several halls of various kinds, No acoustic or optic center exists in those of Group II, and therefore the magnitude of the room is not limited in that respect; but it is frequently so in reference to construction, lighting and other points. Dimensions are generally fixed in accordance with the number of persons expected in the room and area required by each person, whether greater or smaller, according to the mode of use. Data on this point will be given later, when this point can be more fully discussed with the different kinds of buildings.

259. Form of Ceiling; Treatment of Forms.

Everything necessary has already been said in regard to form of the ceiling in reference to acoustics, and in reference to construction and treatment of forms in Art.98, 130 to 135, and 171 to 186. Besides examples there given, forms of cross sections of some halls are represented in Figs. 348 to 351, with internal views in Figs. 352 to 357. The latter illustrate the treatment of the forms, with reference to Arts. 167 to 170.

The great hall of Vecchio Palace in Florence (Fig. 354) is a remarkable Italian example with horizontal ceiling, and the hall of Middle Temple in London (Fig.355) is a similar one of the Elizabethean era with a visible decorated framework of roof. As forms of halls of the modern period are the already mentioned domed rotunda of Old Museum in Berlin (Fig.352), with a free colonnade and aisle around it, and the reading room of National Library in Paris (Fig. 358), which may be assumed as typical; the visible iron construction of the ceiling supports nine domical vaults, covered by colored tiles. The section of the hall of Bourse in Vienna (Fig. 353) shows an intersecting groined ceiling with a large horizontal middle panel; the hall of building of Musik Verein in Vienna (Fig. 349) has a horizontal ceiling, City Hall in Mayence

(Fig. 350) has a ceiling of segmental arched form with visible iron construction, and Albert Hall in London (Fig. 348) has a domed ceiling. The cross section of Concert Hall in Ostend (Fig. 351) recalls Byzantine centralized buildings. A remarkable example of a large hall with galleries and entirely constructed of iron is given in the main hall of Museum of Natural History in Paris (Fig. 357).

280. Location.

A few words remain in regard to location to be assigned to the hall in the building in which it belongs; for one commences with this in designing it according to the principles already developed. The question whether the hall shall be located in a ground or upper story will usually be settled by the requirements of the programme. This decision indeed fixes the entire architectural organism of the work.

Not less important is fixing its location on the plan. The hall is such an important motive for external appearance of the building, that in all cases a prominent position must be assigned to it in the plan. Particularly in monumental buildings it will almost always be best to place it on the main axis, and frequently on the transverse axis of the building also, as in centralized buildings. Yet requirements of suitability and accessibility must not be neglected. (For relation of main entrance and main stairway to that of hall, see Arts. 122 to 215).

We will close this investigation by repeating the last words of Art. 179:- "The highest effect in decoration and the most harmonious lighting should be produced in the chief apartments of the building. In it should be expressed in monumental designs the intellectual significance of the building, in which the form of room, decoration, sculpture, and painting may work together in a harmonious way."


UNIVERSITY OF ILLINOIS
LEARNING & LABOR
AGRICUL-TURE
SCIENCE & ART
1867

END